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Art. XI.—*A Note on the Occurrence of* Didymograptus protobifidus *Elles in the Lower Ordovician of Victoria.*

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Contents.

Introduction and Acknowledgments.

The pendent *Didymograpti* form a small element in the Victorian Lower Ordovician graptolite faunas. They occupy a position in the succession between the beds characterized by a great development and abundance of *Tetragraptus fruticosus* (Hall) (Bendigonian) and those which show the beginning of the rise of *Isograptus gibberulus* (Nicholson), which is found in many forms in the Castlemainian and Darriwilian. This refers particularly to the most abundant pendent form which occurs in the uppermost zone of the Bendigonian and more abundantly in the lowermost zone of the Castlemainian, and which has usually been referred to *Didymograptus bifidus* (J. Hall). Another species (*D. dependulus* Harris and Keble) occurs in the Middle Castlemainian, and is obviously descended from *T. fruticosus,* though along a different line from that which produced the *D. bifidus*-like form.

The publication of a note by G. L. Elles in "The Geology of the Whitehaven District" (Mem. Geol. Surv. Gt. Britain, 1931) on her proposed new species, *Didymograptus protobifidus,* and the subsequent publication, in 1933, of a complete description of this species make it necessary to reconsider T. S. Hall's identification (1914) of the Victorian form with *D. bifidus* (J. Hall). The species has since been identified, and referred to in Victorian lists and tables as *D. protobifidus* Elles (Harris, 1935; Thomas, 1935).

For the loan of the Victorian material on which this note is based, and which was taken to Cambridge in 1933 for examination during research under the supervision of Dr. G. L. Elles, of Newnham College, I am indebted to the Director of the Geological

Survey of Victoria (Mr. W. Baragwanath), who placed the collections in the Geological Survey Museum at my disposal, and to Dr. W. J. Harris, who allowed me the use of specimens in his private collection. In addition, I wish to thank Dr. Harris and Mr. D. E. Thomas for allowing me to use their unpublished notes on this species. Professor W. N. Benson, of the University of Otago, New Zealand, gave me much information about the graptolite assemblages in New Zealand, often from work which was at the time unpublished, and the references to examples of *D. protobifidus* occurring in New Zealand are based on an examination of his specimens. I wish also to thank the Curator of the Geological Survey Museum (Mr. W. S. Abraham) for his invaluable assistance in the forwarding of Victorian specimens to Cambridge during the progress of the work.

Description of the Species.

DIDYMOGRAPTUS PROTOBIFIDUS Elles.

(Text-fig. 1.)

1933. *Didymograptus protobifidus* Elles, Summary of Progress of the Geological Survey, 1932—Part II., p. 98, text-figs. 1-3.

Rhabdosome of variable size, but usually small. Stipes pendent, usually diverging at a small angle; maximum length 3.5 cm., breadth near origin 0.4–0.7 mm., increasing gradually towards the distal end to a maximum of 1.7 mm. Sicula conspicuous. Thecae 12–14 in 10 mm., 2–3 times as long as wide, free for $\frac{1}{3}$ to $\frac{1}{2}$ of length, inclined at 20°–50° to the axis of the stipe.

The sicula is long and slender, and th1[1] appears to originate at a point a short distance above its aperture. Details of the crossing canal and the origin of th1[2] are not observable. The stipes diverge initially at about 90°, but soon curve so that they include a much smaller angle, which however is very variable and depends largely on the mode of preservation. In average specimens the stipes are inclined in their distal parts at about 25°. The thecae are tubular and inclined usually at low angles to the axis of the stipe. Their apertural margins are straight, and may be oblique or normal to the general direction of the stipe, varying with the amount and direction of the compression undergone by the specimen. The ventral walls are straight, so that the theca retains the simple Dichograptid form.

T. S. Hall (1914), in describing some new or little known species of Victorian graptolites, refers under the name of *Didymograptus bifidus* (J. Hall) to some forms which undoubtedly belong to this more primitive species. He describes the rhabdosome as having stipes up to 3 cm. in length slightly increasing in width for the greater part of their length; thecae

11–12 in 10 mm., inclined at from 30° to 50°, four times as long as wide, free for nearly half their length, with apertures normal to the axis of the stipe, concave, with slightly mucronate denticle. The figured specimen is from Wattle Gully, Castlemaine, and shows more considerable widening of the stipes than is usually met with. As shown by G. L. Elles, the true *D. bifidus* of J. Hall, with which this species has in Victoria been compared, is usually larger, having stipes from 2 to 4 cm. in length, which reach a maximum width of 3 mm. The thecae are long and tubular, 3–4 times as long as wide, 13–15 in 10 mm., inclined at 45° and free for $\frac{1}{4}$ of their length. The North American examples of *D. bifidus* (from Levis, Quebec, described by J. Hall, 1865, and from Deep Kill, New York, described by Ruedemann, 1904) show similar differences from the Victorian form (see table, p. 156). Text-figures 8A–D, of *D. protobifidus* Elles, and 9A, B, of *D. bifidus* (Hall), from various British localities, are added for comparison with Victorian forms.

Some examples from the Lower Castlemainian (C5) of Coal Island, Preservation Inlet, South-Western New Zealand closely resemble certain Victorian forms. They are very narrow at the proximal end, the stipes increase in breadth rather slowly, particularly after the first 7–10 thecae, and the overlap of the thecae is never much more than $\frac{1}{2}$, and considerably less than this at the proximal end. Some other specimens from the C5 beds of Cape Providence are small, rather primitive forms; the stipes are narrow, and increase very slowly in breadth, and the overlap of the thecae is never more than $\frac{1}{2}$. A single Bendigonian example was very badly preserved. The stipes appeared to be thicker than those of the C5 specimens, but the overlap of the thecae was very little and the stipes remained of practically uniform breadth. Some specimens from Nelson in the collection of the University of Otago, probably from the Golden Ridge Mine, North-Western Nelson, are to be regarded as *protobifidus-bifidus* transients. They show considerable widening of the stipes, and the overlap of the thecae increases from something less than $\frac{1}{3}$ to $\frac{2}{3}$ at the distal end of the stipe. These are probably on a higher horizon than the Coal Island and Cape Providence forms, and approach more closely some Victorian transients.

It will be seen from the description and figures that *D. protobifidus*, as is noted by G. L. Elles, has many of the characters seen in the proximal end of the true *D. bifidus*, so that further development along the lines of increased overlap and angle of inclination of the thecae should give a series of transients between these two forms, differing from the more primitive *D. protobifidus* in increased size of the rhabdosome and breadth of stipe. Dr. Elles notes (footnote, p. 99, 1933), the occurrence of such transients in the Skiddaw Slate faunas, and

similar forms, of which details are given in the section dealing with evolutional changes in the species, are to be found in the Victorian Lower Castlemainian assemblages.

Horizon.—Upper Bendigonian and Lower Castlemainian (B1 and C5).

Localities.—Water-race, Wattle Gully, Castlemaine; Chewton-Fryerstown road; New Mineral Springs, Daylesford—B1. Steele's Gully, Sailor's Gully, Blacksmith's Gully, Castlemaine; LL/3, LL/4, LL/5, Allot. 76, Parish of Lancefield; LL/13, Pyalong road, and Allot. 75, Parish of Lancefield; Johnson's Creek, Parish of Cornmill; Callaghan's Adit, Bullarto; Glenhope; and various localities in the Bendigo district—C5.

The measurements of Victorian forms in Table I. are taken from the material at present under consideration. They are similar to those given by T. S. Hall, but a slightly greater degree of crowding of the thecae (13 in 10 mm. instead of 11–12 in 10 mm.) is seen, and the thecal apertures are observed to be usually oblique to the axis of the stipe rather than normal to it.

TABLE I.—COMPARISON OF *D. bifidus* (J. HALL) AND *D. protobifidus* ELLES.

—	*D. bifidus.*	*D. protobifidus.*	*D. protobifidus.*	*D. protobifidus.*	*D. bifidus.*	
Locality	Great Britain	Great Britain	Victoria	New Zealand	Deep Kill (Ruedemann), 1905	Levis (J. Hall), 1865
Thecae in 10 mm. ..	13–15	13	12–14	12–14	13–15	..
Overlap of thecae ..	$\frac{3}{4}$ distal	$\frac{1}{2}$	$\frac{1}{2}$ $\frac{2}{3}$	$\frac{1}{3}$–$\frac{2}{3}$	$\frac{1}{2}$–$\frac{3}{4}$	$\frac{2}{3}$–$\frac{3}{4}$
Angle of divergence of stipes (initial)	65°–115°	90°–115°	80°–110°	90°–100°	90°–100°	..
Angle of divergence of stipes (distal)	15°–20°	10°–35°	10°–40°	10°–30°	20°–25°	15°–20°
Width of stipes (proximal)	·8 mm.	·4–·6 mm.	·4–·7 mm.	·35–·6 mm.	..	1·6 mm.
Width of stipes (distal)	2·6 mm.	1·5 mm.	1·7 mm.	1·6 mm.	2·4 mm.	3·1–6·2 mm.
Inclination of thecae (proximal)	30°	20°–40°	20°–45°	30°–40°	30°	..
Inclination of thecae (distal)	45°	30°–70°	35°–50°	35°–45°	45°	48°
Thecal apertures (rel. to axis of stipe)	Very oblique	Oblique	Oblique or normal	Usually oblique	Oblique	..
Maximum length of stipes	2·4 cm.	1·2 cm.	1·0 or less to 3·5 cm.	2 cm., usually smaller	2·6 cm.	..

Evolutional Changes in Didymograptus protobifidus.

The characters whose variation may be taken into account are :—

i. Rate of increase in breadth of the stipes.
ii. Overlap of the thecae.
iii. Size of the rhabdosome.

The changes in the first two characters may be regarded as giving evidence of the operation of a single trend, since the chief factors contributing to an increase in the breadth of the stipe are increased overlap and inclination of the thecae.

Owing to the restricted range of *D. protobifidus* in Victoria there is very little room for the marked variation that is seen in specimens from different horizons in the British Arenigian. As a general rule, the forms appearing in the sub-zones C and D (of *D. nitidus* and of *Isograptus gibberulus*) of the *extensus* zone in Great Britain are small, have stipes of almost uniform breadth, and the thecal overlap is never more than half. Passing up through the sub-zone of *I. gibberulus* and the zone of *D. hirundo,* forms approximating more and more closely to the true *D. bifidus* are seen: the rhabdosome becomes larger, the overlap of the thecae increases and the stipes are broader and show a great increase in breadth from the proximal to the distal end.

In Victoria Bendigonian examples (text figs. 1A–C) approach most closely the earliest British forms, but appear to be somewhat more robust. The rhabdosome is very small, but the broadening of the stipes is more marked. Some C5 examples from Lancefield (LL/13, LL/3) come fairly close to the Bendigonian forms in their small size and in the narrowness of their stipes. The rest of the C5 faunas show a mixture of small and large forms, the former being probably young individuals, since they are similar in all respects to the earlier stages of full-grown individuals. At Blacksmith's Gully (text-figs. 2A, 2B), Sailor's Gully, Castlemaine and Callaghan's Adit, Bullarto (text-fig. 3) the *D. protobifidus* element of the faunas is very similar, a mixture of large and small forms, the former having usually a thecal overlap of $\frac{1}{2}$, rarely increasing to $\frac{2}{3}$. The stipes increase in breadth fairly gradually, at a rate of 0.07–0.09 mm. per theca, for the first 15 thecae, so that in large examples the breadth of the stipe becomes distally almost constant. Some of these are undoubtedly early transients between *D. protobifidus* and *D. bifidus*. Still higher transients are to be found in the Steele's Gully fauna, which contains some forms with exceedingly long stipes (text-figs. 4A, 4B). Here again the breadth of the stipe becomes practically constant after th15, but the rate of increase in breadth has risen to 0.10 mm. per theca and the distal overlap is $\frac{2}{3}$. A couple of examples with 18 thecae in 10 mm. and stipes rather broader than usual may doubtfully be referred to *D. artus* Elles and Wood (text-fig. 5).

The most advanced form seen occurs at Glenhope (text-fig. 7), though it is associated with small forms resembling the *D. protobifidus* of the Upper Bendigonian. The stipes are broad, the thecal overlap is $\frac{2}{3}$, and the whole rhabdosome is taking on the appearance of that of *D. bifidus*. Some C5 examples from the Bendigo district are also rather advanced transients, notably those from 65 BO (Coll. Geol. Surv. Vic., Reg. No. 8666) and 76 BO (Coll. G.S.V., Reg. No. 9697).

To sum up, the Victorian tuning-fork graptolities of B1 and C5 belong with few exceptions to the *D. protobifidus-D. bifidus* group. The Bendigonian forms are nearest to *D. protobifidus*, but the Castlemainian are to be considered as rather primitive *protobifidus-bifidus* transients. Very little difference in the stage of evolution of the C5 members of the group has been observed, though it is possible that with detailed collecting, noting the relative proportions of large and small forms, and the maximum development attained at a given horizon, the evolution of *D. protobifidus* may be used for the finer subdivision of the passage beds characterized by its presence.

Remarks on Assemblages and Correlations.

The examples of *D. protobifidus* on which the above description is based come mainly from the Lower Castlemainian (C5), and more rarely from the uppermost Bendigonian (B1). An example from the New Mineral Springs, Daylesford, is associated with the following B1 assemblage:—

Tetragraptus fruticosus (Hall), 3-stiped.
T. ? *amii* Lapw., Elles and Wood.
Didymograptus extensus (Hall).
Phyllograptus ilicifolius Hall.

Of the C5 assemblages the following, from Blacksmith's Gully, Castlemaine, is typical:—

Didymograptus protobifidus Elles.
D. extensus (Hall).
D. nitidus (Hall), and transients between these two species.
Dichograptus sp.
Goniograptus geometricus Ruedemann.
Tetragraptus bigsbyi (Hall).
T. amii Lapw., Elles and Wood, and abundant young individuals of *T.* cf. *serra* or *T. amii*.

In New Zealand *D. protobifidus* occurs in beds which have been correlated by Benson and Keble (1935) with the uppermost Bendigonian (B1) and Lower Castlemanian (C5) of Victoria. The B1 assemblage of Locality 13, Cape Providence West section contains, in addition to *D. protobifidus*, which is rare, the following species:—

Didymograptus artus Elles and Wood.
D. extensus (Hall).
D. nitidus (Hall), and transients between these two spp.
Tetragraptus fruticosus (Hall), 3 stiped.
T. pygmaeus Ruedemann.
T. quadribrachiatus (Hall).
T. bigsbyi (Hall).
T. taraxacum Ruedemann.

T. serra (Brongniart).
T. amii Lapw., Elles and Wood.
Goniograptus crinitus T. S. Hall.
G. macer T. S. Hall.
Bryograptus sp.

A typical lower C5 assemblage is that from Loc. 32, Coal Island, Preservation Inlet, which contains—

Didymograptus protobifidus Elles.
D. extensus (Hall).
D. cf. *gracilis* Törnquist.
D. cf. *euodus* Lapw.
D. mundus T. S. Hall.
D. nitidus (Hall).
D. similis (Hall).
Isograptus gibberulus var. *primula* Harris (rare), and forms tending towards var. *lunata* Harris.
Tetragraptus amii Lapw., Elles and Wood.
T. harti T. S. Hall.
T. serra (Brongniart).
T. bigsbyi (Hall).
T. taraxacum Ruedemann.
Phyllograptus angustifolius Hall.
P. cf. *ilicifolius* Hall.
P. cf. *typus* Hall.
Diplograptus cf. *inutilis* (Hall).

D. protobifidus is very abundant in the C5 assemblages.

On referring to other graptolitic successions it will be obvious that the primitive tuning-fork graptolite *D. protobifidus* Elles and the more advanced form *D. bifidus* (Hall) with which it has frequently been confused, are associated with very different types of faunas, and that the recognition of the Victorian forms as *D. protobifidus* and early transients between this species and *D. bifidus* has important bearings on the correlation of the Victorian Lower Ordovician graptolitic succession with those of other regions. The uppermost Bendigonian fauna is almost exclusively Dichograptid, with prevalent many-branched pendent and horizontal forms, of which *Tetragraptus fruticosus* (Hall), *T. pendens* Elles, *Goniograptus, Clonograptus* and *Dichograptus* are typical. More advanced forms include the reclined *Tetragrapti,* e.g., *T. serra* (Brongn), *T. bigsbyi* (Hall), scandent four-branched forms (*Phyllograptus*), and horizontal forms with two stipes, of which *Didymograptus extensus* (Hall), *D. nitidus* (Hall) and transients between these two species are the most important. The fauna of the lowermost Castlemainian is similar, but contains a higher proportion of the horizontal and pendent two-stiped forms, and reclined two-stiped forms, e.g., *Isograptus gibberulus* (Nicholson) and its varieties, are

becoming more important. *Didymograptus bifidus* (Hall), on the other hand, is associated in Great Britain and in South America (Bulman, 1931) in the zone of that name with faunas containing a high proportion of Diplograptidae, *Phyllograpti* of high zonal types, e.g., *P. typus* Hall and *P. anna* Hall, and few or no many-branched Dichograptidae. Pendent and horizontal *Didymograpti* are abundant, but these are rarely identical with those occurring at lower horizons. Assemblages resembling those of the *D. protobifidus* passage beds of Victoria and New Zealand are found in Great Britain in the *extensus* zone, and the fauna of the sub-zone c, of *D. nitidus* (Elles, 1933), in which *D. protobifidus* makes its first appearance in the British succession, is probably their equivalent in this succession. This sub-zone is characterized by an abundance of *D. nitidus* (Hall), *D. extensus* (Hall) and *nitidus-hirundo* transients: *D. uniformis* Elles and Wood, *D. simulans* Elles and Wood, *Isograptus gibberulus* (Nicholson) (rather rare), *Didymograptus nicholsoni* Lapworth, *Glyptograptus dentatus* (Brongn.), *Phyllograptus angustifolius* Hall, *P. anna* Hall and *P. ilicifolius* Hall. This sub-zone contains much the same assemblage as the C5 beds of Victoria, with the exception of *Glyptograptus dentatus,* and is similarly followed by beds with abundant *Isograptus gibberulus,* which however does not attain the development reached by Victorian forms, since it is in Britain restricted to the sub-zone of *I. gibberulus* and the zone of *Didymograptus hirundo.*

A tentative correlation of the Victorian and British Lower Ordovician graptolitic successions, based on these considerations, and using the Victorian terminology given by Harris (1935) and Thomas (1935), is suggested in Table II. The Lower Castlemainian, with the uppermost Bendigonian, is on these grounds placed on a level with the *D. nitidus* sub-zone of the British *extensus* zone on account of the presence in it of *D. protobifidus* and early transients towards *D. bifidus,* and the Castlemainian and Bendigonian are therefore condensed, if their vertical extent is compared with that given in some earlier correlations with the British succession (Harris and Keble, 1932). Harris (1933), however, suggests, in dealing with the Isograptidae of Victoria, a correlation similar in essence to that now being put forward, and Benson and Keble (1936) have proposed a similar correlation of the graptolitic successions of New Zealand and Great Britain.

The Darriwilian can safely be placed on a level with the British *hirundo* and *bifidus* zones, on account of the great increase in the proportion of Diplograptidae which, while characterizing both, is at the same time the only feature common to both. In Great Britain the tuning-fork graptolites, after their first appearance in the *nitidus* sub-zone of the *extensus* zone, steadily increase in importance until the climax is reached in the zone of *D. murchisoni,* and they are accompanied for a time by the

higher zonal extensiform *Didymograpti,* which reach their acme of development in the zone of *D. hirundo.* In Victoria, however, the pendent *Didymograpti* are poorly developed: they are practically confined to the *protobifidus* passage beds of B1 and C5, and very few of the higher transients between *D. protobifidus* and *D. bifidus* are seen. Their place is taken at a low horizon in the Castlemainian by the Isograptidae, which quickly assume a dominant position in the assemblages and give character to the graptolite faunas of the rest of the Castlemainian and most of the Darriwilian.

Summary and Conclusions.

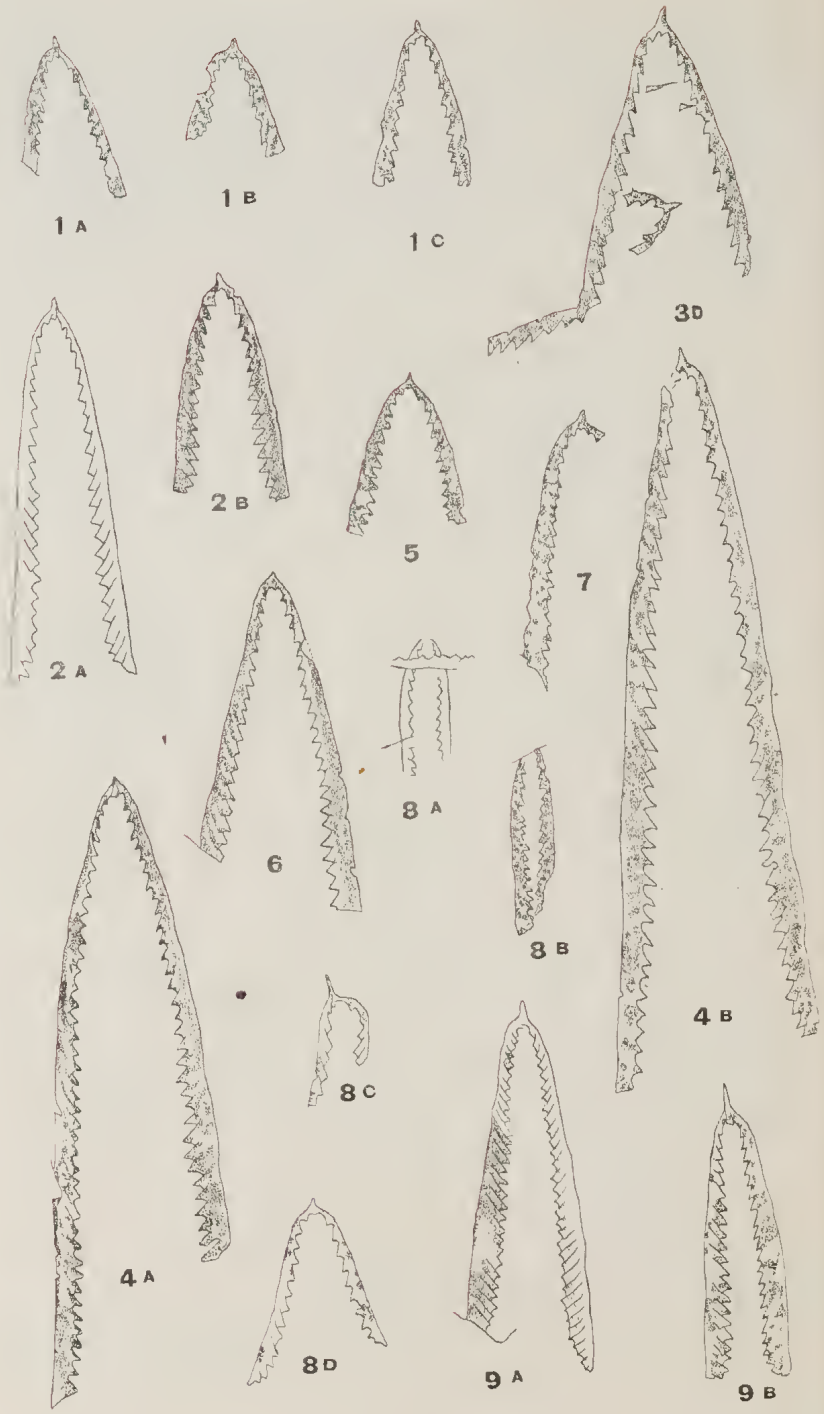
After a careful comparison of Victorian and British specimens, the tuning-fork graptolite occurring most abundantly in the uppermost Bendigonian and Lower Castlemainian (B1 and C5) zones in Victoria is identified with *Diydmograptus protobifidus* Elles, and is fully described. Remarks on the occurrence of the species in New Zealand are added.

Details are given of typical assemblages with which *D. protobifidus* is associated in Victoria and New Zealand, and a comparison is drawn between these and the assemblages with which it is found in Great Britain. Further, these assemblages are contrasted with those in which *D. bifidus,* with which the Victorian form had previously been confused, is found.

From these comparisons and contrasts, it is inferred that the *protobifidus* passage beds of Victoria and New Zealand are best correlated with the sub-zone of *D. nitidus* in the *extensus* zone of Great Britain, and that the Darriwilian consequently finds its equivalent in the *hirundo* and *bifidus* zones of that succession.

Table II.—Showing the Proposed Correlation of the Victorian and British Lower Ordovician Graptolitic Successions.

Great Britain (Lake District). Elles, 1933.	Victoria. Thomas, 1935.	
Zone 6. *Didymograptus bifidus* ..	Darriwilian D2–D1 ..	Zones of *Diplograptus*
„ 5. *D. hirundo*	„ D5–D3 ..	Zones of Isograptidae
Zone 4. *D. extensus*—		
Subzone (*d*) *Isograptus gibberulus* ..	Castlemainian C1–C4 ..	Zones of Isograptidae
„ (*c*) *Didymograptus nitidus* ..	„ C5 ..	Zone of *Didymograptus protobifidus*
„ (*b*) *D. deflexus*	Bendigonian B1 ..	
„ (*a*) Upper subzone of *Tetragraptus* (reclined)	„ B2 ..	
	„ B4–B3 ..	Zone of *Tetragraptus fruticosus*
Zone 3. *Dichograptus*—		
Lower subzone of *Tetragraptus* (horizontal)	Bendigonian B5	Zone of *T. approximatus*
	Lancefieldian L1	
Zone 2. *Bryograptus kjerulfi*	„ L2 ..	Zone of *Bryograptus victoriae*
	„ L3 ..	
	„ L4 ..	Zone of *Staurograptus dilfissus*
Zone 1. *Dictyonema sociale*	.. .. ..	[No equivalent]


1 A
1 B
1 C
3D
2 B
2 A
5
7
6
8 A
8 B
4 B
8 C
4 A
8D
9 A
9 B

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Explanation of Figures.

All figures × 2 approx.

1A. *Didymograptus protobifidus* Elles. Example from water-race near Wattle Gully, Castlemaine. Coll. Geol. Surv. Victoria, Reg. No. 34304. B1.

1B. Same species. New Mineral Springs, Daylesford. Coll. Geol. Surv. Victoria, Reg. No. 4849. B1.

1C. Same species. Between Chewton and Fryerstown. W. J. Harris Collection. B1.

2A. Same species. South of Blacksmith's Gully, Castlemaine. W. J. Harris Collection. C5. A large example showing constant increase in the breadth of the stipes.

2B. Same species and locality. W. J. Harris Collection. A broader example.

3. Same species. Callaghan's Adit, Bullarto. Coll. Geol. Surv. Victoria, Reg. No. 33966. C5.

4A. *D. protobifidus—bifidus* transient. Steele's Gully, S. of railway line between Chewton and Castlemaine. Loc. SG/4. W. J. Harris Collection. C5. A large example.

4B. Same form. Steele's Gully, Loc. SG/5. W. J. Harris Collection. C5.

5. A small form perhaps referable to *D. artus* Elles and Wood. Steele's Gully. Coll. Geol. Surv. Victoria, Reg. No. 33999. C5.

6. *D. protobifidus—bifidus* transient. Steele's Gully. Coll. Geol. Surv. Victoria, Reg. No. 34025. C5.

7. *D. protobifidus—bifidus* transient. Loc. 1, Glenhope. Coll. Geol. Surv. Victoria, Reg. No. 39177. C5. An advanced form approaching *D. bifidus.*

8A. *D. protobifidus.* Mosedale Beck, near Troutbeck, Cumberland. From specimen in Sedgwick Museum, Cambridge (No. 220).

8B. Same species and locality. From specimen in Sedgwick Museum, Cambridge.

8C. Same species. Barf, near Keswick, Cumberland. Coll. Geol. Surv. Victoria, Reg. No. 39175. *D. extensus* zone of the Skiddaw Slates.

8D. Same species Beckstones Gill, Barf, Cumberland. Coll. Geol. Surv. Victoria, Reg. No. 39176. *D. extensus* zone of the Skiddaw Slates.

9A. *D. bifidus* (Hall). Pont Seiont, Caernarvon, N. Wales. Zone of *D. bifidus.* From specimen in Sedgwick Museum, Cambridge (No. 19).

9B. Same species. Long Plantation Cutting, near Clarbeston Road, Haverfordwest, South Wales. Zone of *D. bifidus.* From a specimen in the Sedgwick Museum, Cambridge (No. 329).